PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference TV/14068.3	**FOR FURTHER ACTION**	See Form PCT/IPEA/416
International application No. PCT/CA2005/000209	International filing date *(day/month/year)* 18 February 2005 (18-02-2005)	Priority date *(day/month/year)* 19 February 2004 (19-02-2004)

International Patent Classification (IPC) or national classification and IPC
IPC: ***F01L 7/16*** (2006.01) , ***F01L 7/06*** (2006.01) , ***F01L 31/18*** (2006.01) , ***F02B 57/02*** (2006.01) , ***F02B 57/04*** (2006.01)

Applicant
ENERGY 2020 (CANADA) CORPORATION ET AL

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 7 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. [X] *(sent to the applicant and to the International Bureau)* a total of 55 sheets, as follows:
      [X] sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      [ ] sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. 1 and the Supplemental Box.
   b. [ ] *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).
4. This report contains indications relating to the following items:
   [X] Box No. I Basis of the report
   [ ] Box No. II Priority
   [ ] Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   [X] Box No. IV Lack of unity of invention
   [X] Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   [ ] Box No. VI Certain documents cited
   [ ] Box No. VII Certain defects in the international application
   [X] Box No. VIII Certain observations on the international application

Date of submission of the demand 19 December 2005 (19-12-2005)	Date of completion of this report 30 June 2006 (30-06-2006)
Name and mailing address of the IPEA/CA Canadian Intellectual Property Office Place du Portage I, C114 - 1st Floor, Box PCT 50 Victoria Street Gatineau, Quebec K1A 0C9 Facsimile No.: 001(819)953-2476	Authorized officer William Byrne (819) 997-2565

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/CA2005/000209

Box No. I Basis of the report

1. With regard to the **language,** this report is based on:

[X] the international application in the language in which it was filed

[ ] a translation of the international application into , which is the language of a translation furnished for the purposes of:

[ ] international search (Rules 12.3(a) and 23.1(b))

[ ] publication of the international application (Rule 12.4(a))

[ ] international preliminary examination (Rules 55.2(a) and/or 55.3(a))

2. With regard to the **elements** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

[ ] the international application as originally filed/furnished

[X] the description:

[X] pages 2-10, 12, 13, 17-19, 21-25, 28-31, and 33 as originally filed/furnished

[X] pages* 1, 11, 14-16, 20, 26, 27, 32 received by this Authority on 19 December 2005 (19.12.2005)

[ ] pages* received by this Authority on

[X] the claims:

[ ] pages as originally filed/furnished

[ ] pages* as amended (together with any statement) under Article 19

[X] pages* 124-169 received by this Authority on 13 June 2006 (13.06.2006)

[ ] pages* received by this Authority on

[X] the drawings:

[X] pages 1-20 as originally filed/furnished

[ ] pages* received by this Authority on

[ ] pages* received by this Authority on

[ ] a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing.

3. [X] The amendments have resulted in the cancellation of:

[ ] the description, pages

[X] the claims, Nos. 254, 255, 282

[ ] the drawings, sheets/figs

[ ] the sequence listing *(specify):*

[ ] any table(s) related to sequence listing *(specify):*

4. [ ] This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

[ ] the description, pages

[ ] the claims, Nos.

[ ] the drawings, sheets/figs

[ ] the sequence listing *(specify):*

[ ] any table(s) related to sequence listing *(specify):*

* *If item 4 applies, some or all of those sheets may be marked "superseded."*

Box No. IV Lack of unity of invention

1 [ ] In response to the invitation to restrict or pay additional fees the applicant has, within the applicable time limit:

[ ] restricted the claims

[ ] paid additional fees

[ ] paid additional fees under protest and, where applicable, the protest fee

[ ] paid additional fees under protest but the applicable protest fee was not paid

[ ] neither restricted the claims nor paid additional fees.

2 [X] This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.

3 This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is:

[ ] complied with

[X] not complied with for the following reasons:

The claims are directed to a plurality of alleged inventions.

Group A - Claims 1-202, 252-265, 270, 271, and 273-281
Group B - Claims 203-240, and 272
Group C - Claims 241-245
Group D - Claims 246-250
Group E - Claim 251
Group F - Claims 266-269

Continued on Supplemental Sheet.

4. Consequently, this report has been established in respect of the following parts of the international application:

[X] all parts

[ ] the parts relating to claims Nos.

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/CA2005/000209

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-202, 206, 208-211, 218-250, 252-271, 273-281	YES
	Claims	203-205, 207, 212-217, 251, 272	NO
Inventive step (IS)	Claims	1-202, 206, 208-211, 218, 225-231, 234-250, 252-271, 273-281	YES
	Claims	203-205, 207, 212-217, 219-224, 232, 233, 251, 272	NO
Industrial applicability (IA)	Claims	1-281	YES
	Claims	NONE	NO

2. Citations and explanations (Rule 70.7)

D1 US 1227698 (TIBBETTS) 1917-05-29
D2 US 1726299 (HEURICH ET AL) 1927-08-27
D3 US 5076219 (PELLERIN) 1991-12-31
D4 US 5988133 (AGAPIADES) 2000-10-08
D5 US 1034877 (COFFIN ET AL) 1912-08-06

D1 teaches a disc valve arrangement for an internal combustion engine, the arrangement comprising a cylinder head manifold and a cylinder. The arrangement comprises a disc valve having an upper face for sliding contact with the underside of the cylinder head manifold, and a lower face adjacent the cylinder and defining a combustion chamber. The disc further has a plurality of ports therein for permitting periodic fluid communication between the cylinder head manifold and the cylinder, upon rotation of the disc valve.

D2 teaches a disc valve arrangement for an internal combustion engine, the arrangement comprising a disc valve having an upper face for sliding contact with the underside of the cylinder head manifold, and a lower face adjacent the cylinder and defining a combustion chamber. The disc further has a plurality of ports therein for permitting periodic fluid communication between the cylinder head manifold and the cylinder, upon rotation of the disc valve. The disc further comprises a circumferential annular ring protruding from an upper surface thereof adjacent a circumferential ridge, for receipt in a corresponding groove in the cylinder head.

D3 teaches a disc valve arrangement for an internal combustion engine, the arrangement comprising a disc valve having an upper face for sliding contact with the underside of the cylinder head manifold, and a lower face adjacent the cylinder and defining a combustion chamber. The disc further has a plurality of ports therein for permitting periodic fluid communication between the cylinder head manifold and the cylinder, upon rotation of the disc valve. The disc is further characterized in that it has a receding frustoconical/semi-spherical centre area to provide turbulent mixing. The disc further comprises a central aperture for the extension of a spark plug therethrough.

D4 teaches a disc valve arrangement for an internal combustion engine, the arrangement comprising a cylinder head manifold and a cylinder. A disc valve is provided having a rotation axis parallel to and coincide with a cylinder axis, and having ports therein for permitting periodic fluid communication between the cylinder head manifold and the cylinder. The arrangement is further characterized in that a lower side of the disc is provided with bevel gear teeth for connection, through various drive means, to a crankshaft such that the crankshaft and disc valve are in timed relation.

D5 teaches a disc valve arrangement for an internal combustion engine, the arrangement comprising a cylinder head manifold and a cylinder. The arrangement comprises a disc valve comprising a disc having an upper face for sliding contact with the underside of the cylinder head manifold, and a lower face adjacent the cylinder and defining a combustion chamber. The disc further has a port therein for permitting periodic fluid communication between the cylinder head manifold and the cylinder, upon rotation of the disc valve. Further provided is a seal for sealing between the disc and the cylinder, the seal providing a static seal with the cylinder and a dynamic seal with the disc. The arrangement further provides for a fluid bearing and seal between the disc upper face and the cylinder head face.

Continued on Supplemental Sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

The description does not comply with **Article 5 of the PCT**. A statement in an application, such as found on page 11, lines 3, 8, and 11 which incorporates by reference any other document, does not comply with PCT Article 5. The description should be complete in and of itself. A person skilled in the art should be able to understand the patent specification without reference to any other document.

The description does not comply with **Article 5 of the PCT**. All documents referred to in the description must be available to the public. Reference to the document on page 11, lines 5 and 7, must be deleted or replaced by its corresponding patent number or publication number.

Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**

Continuation of: Box IV

Group A - Claims 1-202, 252-265, 270, 271, and 273-281 are directed to a disc valve system for an internal combustion engine, and a seal therefor, characterized in that the seal is interposed between the disc valve and a cylinder, mounted within the cylinder, and forms a dynamic seal with the disc and a stationary seal with the cylinder;

Group B - Claims 203-240, and 272 are directed to a rotating disc valve characterized by a turbulator associated with a side thereof adjacent to, and forming the upper surface of, a cylinder;

Group C - Claims 241-245 are directed to a rotating disc valve characterized by shutter members for varying the size of valving apertures;

Group D - Claims 246-250 are directed to a rotating disc valve characterized by 'a plurality of intake and exhaust sequencing ports of differing dimensions disposed in respective intake and exhaust series';

Group E - Claim 251 is directed to a rotating disc valve characterized by a circular protrusion proximate the periphery of the disc; and

Group F - Claims 266-269 are directed to a timing gear drive for a disc valve engine.

For Unity of Invention to exist all claims must be characterized by the same technical inventive feature.

The claims of Group A through E are broadly directed to a rotating disc valve and a sealing arrangement therefor. The sole elements shared by all of these claim groupings is the provision of a disc valve comprising a disc having an upper face for sliding contact with the underside of a cylinder head manifold, and a lower face adjacent a cylinder and defining a combustion chamber. The disc further has a port therein for permitting periodic fluid communication between the cylinder head manifold and the cylinder, upon rotation of the disc valve. Further provided is a seal for sealing between the disc and the cylinder, the seal providing a static seal with the cylinder and a dynamic seal with the disc.

However, all of these elements are known from the Coffin et al. patent document (D5), resulting in an 'a posteriori' lack of Unity of Invention for Claim Groups A through E. The claim groupings do not share an inventive feature of any other Claim Group.

Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**

Continuation of: Box V

1. **Claim 251** lacks novelty under **PCT Article 33(2)** in view of document D2.

   As written this claim attempts to define precisely the arrangement of document D2. The similarity would preclude the patentability of this claim.

2. **Claims 203-205, 207, 212-217, and 272** lack novelty under **PCT Article 33(2)** in view of document D3.

   As written these claims attempt to define precisely the arrangement of document D3. The similarity would preclude the patentability of these claims.

3. **Claims 219-222** lack an inventive step under **PCT Article 33(3)**. The subject matter of these claims would have been obvious on the claim date to one skilled in the art, having regard of D3, in view of D4.

   The subject matter of the above claims differs from the teachings of D3 in that they provide the rotating disc with bevel gear elements on a periphery of the inner face thereof. However, this feature is taught by D4.

4. **Claims 223, 224, 232, and 233** lack an inventive step under **PCT Article 33(3)**. The subject matter of these claims would have been obvious on the claim date to one skilled in the art, having regard of D3, in view of D1.

   The subject matter of the above claims differs from the teachings of D3 in that they provide the rotating disc with a plurality of ports comprising apertures. However, this feature is taught by D1.

5. The above cited documents fail to teach that the rotating disc is provided with bevel gear elements on a periphery inner face thereof, and a further arrangement of sprockets and gears to connect the disc valve to a crankshaft in timed relation thereto. Therefore **claims 219-222** appear to meet the requirements of **PCT Article 33(2)**.

6. The above cited documents fail to teach the provision of a disc with a plurality of ports comprising apertures. Therefore **claims 223, 224, 232, and 233** appear to meet the requirements of **PCT Article 33(2)**.

7. The above cited documents fail to teach the feature of the sequencing ports comprising shutter members. Therefore **claims 225-231, and 241-245** appear to meet the requirements of **PCT Articles 33(2) and 33(3)**.

8. The above cited documents fail to teach the feature of sequencing ports located along different respective orbitals. Therefore **claim 234** appears to meet the requirements of **PCT Articles 33(2) and 33(3)**.

9. The above cited documents fail to teach the feature of a plurality of each of intake and exhaust sequencing ports. Therefore **claims 235, 236 and 246-250** appear to meet the requirements of **PCT Articles 33(2) and 33(3)**.

10. The above cited documents fail to teach the feature of a seal member comprising a top and a bottom face, and an outer surface therebetween, the top face being in contact with the rotating disc and providing for said disc to rotate with respect thereto, and wherein the seal member is located with an engine cylinder. Therefore **claims 1-202, 252-265, 270, 271, and 273-281** appear to meet the requirements of **PCT Articles 33(2) and 33(3)**.

11. The above cited documents fail to teach the feature of a turbulator comprising a propeller. Therefore **claims 206, and 208-211** appear to meet the requirements of **PCT Articles 33(2) and 33(3)**.

12. The above cited documents fail to teach the feature of a disc valve comprising a skirt for mating with an engine cylinder. Therefore **claim 218** appears to meet the requirements of **PCT Articles 33(2) and 33(3)**.

13. The above cited documents fail to teach the feature of a disc valve having series of intake and exhaust ports each having ports of different dimensions . Therefore **claims 237-240** appear to meet the requirements of **PCT Articles 33(2) and 33(3)**.

14. The above cited documents fail to teach the feature of a timing gear comprising a resilient member. Therefore **claims 266-269** appear to meet the requirements of **PCT Articles 33(2) and 33(3)**.

15. **All claims** appear to meet the requirements of Industrial Applicability and Utility under **PCT Article 33(4)**.

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TITLE OF THE INVENTION

DISC VALVE SYSTEM

FIELD OF THE INVENTION

The present invention relates to disc valve system. More specifically, the present invention is concerned with disc valve system for a piston driven internal combustion engine as well as an engine comprising such a disc valve system.

BACKGROUND OF THE INVENTION

United States Patent N° 5,988,133 issued to Agapiades et al. on November 23, 1999 teaches a rotating disc valve that opens an closes exhaust and intake ports of a cylinder head in order to provide communication with the combustion chamber. This disc is rotatively mounted within the cylinder head of an internal combustion engine having beveled gear teeth at its outer perimeter and a plurality of equally-spaced ports about its center of rotation which will meet with a like number of sets of exhaust and intake conduits within the cylinder head for cyclic indexing therewith. These exhaust and intake conduits lead from the combustion chamber to a respective exhaust and intake manifold. The disc valve rotates synergistically with the crankshaft via a chain mounted to a sprocket on the crankshaft as well as to a second sprocket which is in operative communication with a pinion gear having bevel teeth meshed with the bevel teeth of the disc.

It should be noted that the general functioning of a disc valve system is disclosed in United States Patent 5,988,133, which is incorporated herein by reference. The present application is based on the following priority documents: United States patent application number 10/783,137 filed on February 19, 2004 and titled "Disc Valve Intermediate Ring Seal" and United States patent application number 10/783,110 filed on February 19, 2004 and titled "Timing Gear Flexible Coupling" which are incorporated herein by reference. The present application also requests priority on the United States Provisional Patent Application filed on 18 January 2005 and titled "Disc Valve System", which is incorporated herein by reference.

With reference to the appended drawings, embodiments of the invention will be herein described so as to exemplify the invention and not limit its scope.

Figure 1 shows the disc valve system 10 in accordance with an embodiment of the invention.

Disc valve system 10 is to be mounted on an engine E (as shown in Figure 6). The present invention also provides an engine E including the disc valve system such as 10 of the present invention.

The disc valve systems of the present invention can be mounted to a variety of piston-driven engines. The engines of the invention, can be for any type of transport vehicle such as an automobile or a motorcycle for example; these can be used for equipment such as gardening equipment and the like; these engines can be two stroke or four-stroke piston engines. Hence, the disc valve

via the chain 32 mounted to both the first and second sprocket gears 28 and 30. The second sprocket gear 30 includes an aperture 31 for receiving an extending member such as a rod or shaft 35, which extends from bevel pinion gear 33.

Figure 2 also shows the cylinder box 95 in dotted form.

Figure 3 is similar to Figure 1 except that the cylinder head manifold 14 and engine cylinder 16 have been removed. The disc 12 comprises a top or outer face 38 and a bottom or inner face 40. In this embodiment, the inner face 40 comprises the bevel teeth 36 near the periphery thereof and a sealing portion 42 including a skirt 44.

With reference to Figure 7, skirt 44 mates with and covers a portion of the engine cylinder 16. Flexible seals 45 are positioned between the disc 12 and the engine cylinder 16.

Turning back to Figure 3, the outer face 38 comprises a top sealing surface 46 as well as a central tubular shaft 48.

As shown in Figure 7, the shaft 48 is rotatably mounted in the cylinder head manifold 14 and the top sealing surfaces 46 are in slidable contact with this cylinder head manifold 14. Flexible seals 49 are placed between the disc 12 and the cylinder head 14.

Turning back to Figure 3 and with reference to Figure 7, an ingnitor such as a spark plug 51 (which can be replaced by a fuel injector) is mounted to the tubular shaft 48.

In the embodiment, shown in Figure 5, the disc 12 has a short tubular shaft 47 and the spark plug 51 (which can be

replaced by a fuel injector) is mounted directly to the cylinder head manifold 14 which defines a receiving aperture 89.

With reference to Figures 3, 5, 7, 8, 19, 22 and 23, an intermediate seal member 50 (or 50A) is positioned between the disc 12 and the engine cylinder 16, for sealing the combustion chamber 18 at a junction of the disc 12 and the engine cylinder 16.

Figure 4 shows the disc valve system 52, in accordance with another embodiment thereof. Only the features, which are different from disc valve system 10 will be described herein for concision purposes only. In the disc valve system 52, the disc-rotator is a transmission assembly 53 in operative communication with the crankshaft 24 and the disc 12. Again this transmission assembly 53 is a gear assembly. The engine valve train components of gear assembly 53 for transferring the movement of the crankshaft 24 to the disc 12 include first and second gears in the form of pinion gears 54 and 56 that are in operative commutation via a movement transfer assembly 60. The first pinion gear 54 is fixedly mounted to the crankshaft 24. The second pinion gear 56 is in operative communication with the disc 12. The movement transfer assembly 60 includes an elongate member 62 being rotatable about its longitudinal axis Y. This elongate member 62 includes first and second elongate-member gears 64 and 66 respectively at the longitudinal ends thereof. Pinion gear 54 includes bevel teeth 68, which are meshed with the bevel teeth 70 of pinion gear 64. Pinion gear 66 includes bevel teeth 72, which are meshed with bevel teeth 74 of disc gear 56. Disc gear 56 is a double pinion gear and includes a second opposite face with bevel teeth 76, which acts as a disc-gear. Bevel teeth 76 are meshed with the bevel teeth 34 of the disc 12.

In this case, gears 54 and 68 are the first and second gears, and the rotating rod 62 is the movement transmission assembly.

In this way, the movement of crankshaft 24 is transferred to disc 12 via rod 62 being acted upon by pinion gear 54, which acts on double pinion disc-gear 56, which in turn acts on disc 12.

Of course a variety of methods for transferring the movement of the crankshaft 24 to the disc 12 can be contemplated by the ordinarily skilled artisan such as using a plurality of operatively communicating gears to give but one example. Of course it should be noted that the disc 12 is to move synergistically with the piston 12 since the rotating movement of the disc provides intake and exhaust and the translational movement T of the piston 20 provides compression. Timing the movements of the disc 12 and the piston 20 can be provided in a variety of ways known to the skilled artisan within the context of the present invention.

FIGS. 1, 2, 5, 6, 7, 8, 9 and 10 show the cylinder head manifold 14 including an intake conduit 78 leading to an intake port 80 and an exhaust conduit 82 leading to an exhaust port 84. As shown in Figures 9 and 10, the rotating disc valve 12 includes an intake sequencing port 81 as well as an exhaust sequencing port 85 which are configured as to be brought into periodic communication with exhaust and intake ports 80 and 84 respectively, so as to open these ports as shown in Figure 9 or close these ports as shown in Figure 10 at cyclic intervals of the rotating movement of rotating disc 12, thereby providing for the intake and exhaust ports 80 and 84 to be brought into periodic communication with the combustion chamber 18.

Figures 15 and 16 show a rotating disc 118 in accordance with another embodiment of the invention. Again, this disc 118 includes bevel teeth 36 on its underside or inner face 40, and ports 120 and 122. The ports 120 and 122 include respective shutter members in the form of moveable members 124 and 126, which are biased towards an at least partially closed position, as shown in Figure 15; thus making the aperture defined by ports 120 and 122 smaller via a biasing member 128 in the form of a spring mounted to a port wall 129. As shown in Figure 16, during rotation in the direction shown by arrow R, the shutters 124 and 126, move towards the external periphery of disc 118, as shown by arrows I and II, via a centrifuge action that is dependent on the speed of rotation and such increasing the size of ports 120 and 122. As the rotation of the disc 118 slows down, this centrifuge action will decrease and the biasing force of the tension spring 128 will move the shutters 124 and 126 towards the centre of the disc 118, which includes a generally central aperture 119, hence decreasing the size of ports 120 and 122.

Hence, intake or exhaust will increase with the speed of rotation or via the complementary intake and exhaust ports (such as ports 80 and 84 for example) of a cylinder head 14 meeting with ports 120 and 122 more frequently, and via these ports 120 and 122 becoming larger with the higher rotational speed.

Figure 17 shows the outer face 38 of a rotating disc 130, in accordance with an embodiment of the invention. The disc 130 includes two ports 131 and 132 a ridge 98 and a central aperture 133. Ports 131 and 132 have shutter members in the form of flaps 134 and 136 respectively. These flaps 134 and 136 are mounted to respective biasing members 138 in the form of a coil mounted to the outer face

the engine cylinder 16 so as to seal the combustion chamber 18 at a junction of the rotating disc and the engine cylinder 16.

The intermediate seal member comprises a dynamic seal 168 for contact with said rotating disc, such as 12 for example, and a stationary seal 170 for sealing contact with the engine cylinder 16.

The intermediate seal members 50 and 50A comprise an upper face 172, a bottom face 174 and an intermediate surface 176. In this example, the intermediate seal members are in the form of rings.

Ring seals 50 and 50A effectively seal the combustion chamber 18 defined by the engine cylinder 16 by forming a dynamic sliding seal with the rotating disc 12 and a static or stationary seal with the engine cylinder 16 within the limiting axial distance of the combustion volume when the engine piston 21 is at top dead centre at the end of its compression stroke.

In previous designs and proprietary illustrations, the stationary sealing contact has been in the cylinder head. The stationary seal of the intermediate rings 50 and 50A of the present invention is at the engine cylinder inside surfaces 179.

Ring members 50 and 50A include the stationary seal 170 at the intermediate surface 176. In this embodiment, the stationary seal is an o-ring extending beyond surface 176 and slidably held within a groove machined at the outer perimeter of surface 176.

The bottom faces 174 of ring seals 50 and 50A are configured to be fitted within the cylinder 16 and mate with the inner top surface 178 thereof. Furthermore, the bottom faces 174 (or edges) include locking members in the form of a recess. Ring seal 50 includes an inclined recess 180 whereas ring seal 50A includes a straight recess 182. Recesses 180 and 182 are formed to accept complementary locking members in the form of pins 184 and 186 at the inner top perimeter surface 179 of cylinder 16 for holding the intermediate ring seals 50 and 50A in place and preventing their rotation.

Since, the top faces 172 of both ring seals 50 and 50A are in a dynamic seal contact with any of the disc valves of the present invention, they provide for the disc valves to rotate with respect thereto.

The stationary seal 170 is in sealing relationship with surface 179 of the cylinder 16 with top face 172 being contiguous with cylinder rim 177.

The bottom face 174 of each ring seal 50 and 50A is in a static stationary seal within the cylinder 16. The top internal periphery 178 of the piston cylinder 16 is recessed and forms a seating arrangement that is complementary to a given bottom face 174 in order for the rings 50 or 50A to be seated thereon in sufficient fit.

An aspect of this invention is the method of sealing the combustion chamber of a rotary disc valve engine between the cylinder head and the engine cylinder. At the cylinder 16 the intermediate ring seal 50 or 50A provides a static seal with the engine cylinder 16 by a seal 170 operating within a seal groove 171 (see Figure 7) machined

cylinder box 95 via spring members 196 and 198 respectively. The tensions elements 190 and 192 may also be mounted via flexible resilient members to the dynamic member 194. When the sprockets 28 and 30 turn as shown by arrows A and the chain is in movement, as shown by arrows C it will act on the tensioner system 188. One side 200 of the chain 28 will act on tension element 190 and as such element 190 will push chain side 29 inwards as shown by arrow B, the dynamic member 194 will push tension element 192 in the same direction B' . The foregoing will cause the dynamic member 194 or the biasing members 196 and 198 mounted to tension elements 190 and 192, via an equal and opposite reaction to the movement represented by arrows B and B', to act on tension element 192 to push side 202 of the chain 32 inwardly as shown by arrow D, simultaneously the dynamic member 194 will push the tension element 174 in the same direction as shown by arrow D'. This reciprocating movement represented by arrows B, B' and D, D' causes the second gear 30 to slow down or rotate in a non-constant speed, which has the same effect on the disc 12, hence slowing down a given intake or outtake port on the disc 12 from meeting its complementary outtake or intake aperture on a cylinder head 14, in such a way as to cause a non-uniform sequencing by causing this periodic tension on the chain 32.

Engines start easier at high compression. For increased operating reliability the disc valve engine timing is designed for high compression starting at retarded intake and exhaust port openings. At high speed operation dynamic flow losses and system resistances in the manifolding circuits are alleviated by early intake and exhaust port opening increasing the engine efficiency by advancing the effective period of the power cycle under load. Valve timing improves

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WHAT IS CLAIMED IS:

1. A disc valve system for a piston driven internal combustion engine, said disc valve system comprising:

at least one rotating disc for mounting between a cylinder head manifold comprising exhaust and intake ports and an engine cylinder housing the piston and defining a combustion chamber, said rotating disc comprising sequencing ports so configured as to be brought into periodic communication with said exhaust and intake ports at cyclic intervals of the rotating movement of said rotating disc thereby providing for said exhaust and intake ports to be brought into periodic communication with said combustion chamber; and

an intermediate seal member for mounting in the engine cylinder at a junction of said rotating disc and the engine cylinder so as to seal the combustion chamber, said intermediate seal member comprising a dynamic seal for contact with said rotating disc and a stationary seal for sealing contact with the engine cylinder;

whereby the rotating movement of said rotating disc sequentially opens and closes each said exhaust and intake ports synergistically with the translational movement of the piston

2. A disc valve system according to claim 1, wherein said disc comprises a generally central aperture for being in alignment with an aperture of the cylinder head manifold.

3. A disc valve system according to claim 2, wherein said cylinder head manifold aperture is defined by a spark-plug receiving portion.

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4. A disc valve system according to claim 3, wherein said spark-plug receiving portion defines a threaded portion for fixedly receiving a spark-plug.

5. A disc valve system according to claim 2, wherein said cylinder head manifold aperture is defined by a fuel-injector receiving portion.

6. A disc valve system according to claim 5, wherein said fuel-injector receiving portion defines a threaded portion for fixedly receiving a fuel injector

7. A disc valve system according to claim 1, wherein said disc comprises an outer face in a slidable sealing relationship with the cylinder head manifold and an opposite inner face in a slidable relationship with said intermediate seal member.

8. A disc valve system according to claim 7, wherein said outer face comprises a generally central protrusion for slidably mating with a complementary indentation within the cylinder head manifold.

9. A disc valve system according to claim 8, wherein said generally central protrusion comprises a tubular shaft.

10. A disc valve system according to claim 9, wherein said tubular shaft defines an aperture for fixedly receiving a spark plug.

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11. A disc valve system according to claim 9, wherein said tubular shaft defines an aperture for fixedly receiving a fuel injector.

12. A disc valve system according to claim 7, wherein said outer face comprises a generally circular protrusion for slidably mating with a complementary indentation comprised by the cylinder head manifold.

13. A disc valve system according to claim 12, wherein said complementary indentation is defined by a layer of material added on the cylinder head manifold.

14. A disc valve system according to claim 13, wherein said layer of material is selected from the group consisting of: copper and anti-friction material.

15. A disc valve system according to claim 12, wherein said complementary indentation is formed within the cylinder head manifold.

16. A disc valve system according to claim 7, wherein said inner face comprising a turbulator portion configured to provide for turbulence thereunder during the rotating movement of said disc.

17. A disc valve system according to claim 16, wherein turbulator portion further comprises propeller members.

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18. A disc valve system according to claim 16, wherein said turbulator portion comprises a receding region within said inner face.

19. A disc valve system according to claim 18, wherein turbulator portion further comprises propeller members about said receding portion.

20. A disc valve system according to claim 19, wherein said propeller members comprise blade members.

21. A disc valve system according to claim 20, wherein said blade members are generally circular shaped.

22. A disc valve system according to claim 19, wherein said sequencing ports comprise apertures which through said propeller members.

23. A disc valve system according to claim 18, wherein said receding region is generally conical shaped.

24. A disc valve system according to claim 7, wherein said inner face comprises a skirt portion for mating with the engine cylinder.

25. A disc valve system according to claim 24, wherein said skirt portion and the cylinder engine comprise a sealing material therebetween.

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26. A disc valve system according to claim 1, wherein said rotating disc comprises gear elements.

27. A disc valve system according to claim 26, wherein said gear elements comprise bevel teeth.

28. A disc valve system according to claim 26, wherein said rotating disc comprises an inner face comprising said gear elements.

29. A disc valve system according to claim 28, wherein said gear element is formed near the periphery of said rotating disc.

30. A disc valve system according to claim 1, wherein said cylinder head manifold and said disc comprise a sealing material therebetween.

31. A disc valve system according to claim 1, wherein said sequencing ports comprise at least one intake sequencing port and at least one exhaust sequencing port.

32. A disc valve system according to claim 1, wherein said sequencing ports comprise apertures.

33. A disc valve system according to claim 32, wherein said sequencing ports comprise respective shutter members.

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34. A disc valve system according to claim 33, wherein said shutter are so biased as to at least keep said port apertures partially closed.

35. A disc valve system according to claim 34, wherein said shutters are moveable towards a position that progressively opens said port apertures during the rotating movement of said disc.

36. A disc valve system according to claim 35, wherein a said shutter comprises a moveable member positioned within said aperture, and mounted to a port wall via a biasing member.

37. A disc valve system according to claim 36, wherein said biasing member comprises a spring.

38. A disc valve system according to claim 33, wherein said shutters comprise flaps which are mounted to said disc via a biasing member so biasing said flaps as to at least substantially cover said sequencing port apertures.

39. A disc valve system according to claim 38, wherein said biasing member comprises spring.

40. A disc valve system according to claim 31, wherein during the rotating movement of said disc, said intake sequencing port is brought into periodic communication with said cylinder head intake port and said exhaust sequencing port is brought into periodic communication with said cylinder head exhaust port.

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41. A disc valve system according to claim 40, wherein said at least one intake sequencing port and at least one exhaust sequencing port are moved by the rotating movement of said disc along a same orbital.

42. A disc valve system according to claim 40, wherein said at least one least one intake sequencing port and at least one exhaust sequencing port are moved by the rotating movement of said disc along different respective orbitals.

43. A disc valve system according to claim 1, wherein said sequencing ports comprise a plurality of intake sequencing ports and a plurality of exhaust sequencing ports.

44. A disc valve system according to claim 43, wherein said plurality of intake and exhaust sequencing ports are disposed in respective intake and exhaust series on said rotating disc.

45. A disc valve system according to claim 44, wherein said series of said plurality of intake sequencing ports comprises intake ports of different dimensions.

46. A disc valve system according to claim 45, wherein said plurality of intake sequencing ports comprises sequencing ports that increase in size in the direction from the centre of said disc to the periphery of said disc.

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47. A disc valve system according to claim 44, wherein said series of said plurality of exhaust sequencing ports comprises exhaust ports of different dimensions.

48. A disc valve system according to claim 47, wherein said plurality of exhaust sequencing ports comprises sequencing ports that increase in size in the direction from the centre of said disc to the periphery of said disc.

49. A disc valve system according to claim 1, wherein the cylinder head manifold comprises liquid bearings on a portion thereof that is in contact with said disc.

50. A disc valve system according to claim 49, wherein said liquid bearings comprise channels formed within said cylinder head manifold portion.

51. A disc valve system according to claim 50, wherein said cylinder head manifold comprises a material plated on said portion, said liquid bearings comprising channels formed within said plated material.

52. A disc valve system according to claim 1, wherein said intermediate seal member comprises a top face, a bottom face and an outer surface therebetween, said top face being in contact with said rotating disc and providing for said disc to rotate with respect thereto.

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53. A disc valve system according to claim 52, wherein said intermediate seal member comprises a ring member.

54. A disc valve system according to claim 52, wherein said outer surface comprises said stationary seal.

55. A disc valve system according to claim 54, wherein said stationary seal comprises a ring seal.

56. A disc valve system according to claim 54, wherein said stationary seal seals the internal periphery of the engine cylinder about an opening thereof leading to the combustion chamber.

57. A disc valve system according to claim 54, wherein said stationary seal extends beyond said seal member outer surface.

58. A disc valve system according to claim 54, wherein said stationary seal is slidably mounted on said outer surface

59. A disc valve system according to claim 54, wherein said outer surface comprises a groove to hold said stationary seal.

60. A disc valve system according to claim 59, wherein said groove slidably holds said stationary seal.

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61. A disc valve system according to claim 52, wherein said bottom face comprises at least one locking element to be mated with a complementary locking element of the engine cylinder.

62. A disc valve system according to claim 61, wherein at least one said bottom face locking element comprises a recess and said complementary engine cylinder locking element comprises a pin.

63. A disc valve system according to claim 62, wherein said recess is generally vertical with respect to said bottom face.

64. A disc valve system according to claim 62, wherein said recess is generally slanted with respect to said bottom face.

65. A disc valve system according to claim 52, wherein said bottom face comprises a configuration that is complementary to an inner top peripheral region of said cylinder.

66. A disc valve system according to claim 61, wherein said bottom face securely sits on said inner top peripheral region within the engine cylinder.

67. A disc valve system according to claim 1, further comprising a disc-rotator assembly for causing the rotational movement of said rotating disc.

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68. A disc valve system according to claim 67, wherein said disc-rotator assembly comprises a transmission assembly, the piston-driven engine comprising a crankshaft mounted to the piston, said transmission assembly being configured to be put in operative communication with the crankshaft and with said rotating disc such that said disc rotates in relation to the revolution of the crankshaft thereby providing for said disc to sequentially open and close each said exhaust and intake ports synergistically with the revolution of the crankshaft.

69. A disc valve system according to claim 68, wherein said transmission assembly comprises a gear assembly, said disc comprising gear elements in operative communication with said gear assembly.

70. A disc valve system according to claim 69, wherein said gear elements comprise bevel teeth.

71. A disc valve system according to claim 69, wherein said gear assembly comprises a first gear in operative communication with said crankshaft, said first gear being in operative communication with a second gear, said second gear being in operative communication with said disc gear elements so as to transmit the movement of the crankshaft to said disc.

72. A disc valve system according to claim 71, wherein said first gear is mounted to said crankshaft.

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73. A disc valve system according to claim 71, wherein said gear assembly further comprises a movement-transfer assembly in operative communication with both said first and second gears for transmitting the movement of said first gear to said second gear.

74. A disc valve system according to claim 72, wherein said first and second gears comprise first and second sprocket gears respectively, said movement-transfer assembly comprises a chain member mounted at one end to said first sprocket gear and at an opposite end to said second sprocket gear.

75. A disc valve system according to claim 74, further comprising a tension-assembly being in contact with said chain member as to apply tension thereto thereby interruptingly retarding the rotating movement of said disc at given intervals thereof.

76. A disc valve system according to claim 75, wherein said chain member defines two opposite chain sides between said first and second sprocket gears, said tension-assembly comprising tension elements mounted on said opposite chain sides.

77. A disc valve system according to claim 76, wherein said tension-assembly further comprises a dynamic member mounted to said tension elements.

78. A disc valve system according to claim 77, wherein said dynamic member is made of resilient material.

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79. A disc valve system according to claim 77, wherein said tension-assembly comprises first and second opposite tension elements being mounted to a respective chain side, said dynamic member comprising an elongate member having said first and second tension elements mounted at each longitudinal end thereof.

80. A disc valve system according to claim 79, wherein said first and second tension elements are mounted to biasing members for being biased towards a respective said chain side.

81. A disc valve system according to claim 80, wherein said biasing members comprise tension springs.

82. A disc valve system according to claim 79, wherein said first and second tension elements are so positioned and wherein said dynamic member is so configured as to collectively and reciprocally move side-to-side when said chain member acts on at least one of said first and second tension elements.

83. A disc valve system according to claim 82, wherein said reciprocal movement provides for applying interrupted pressure on a each of said chain sides at a time and at substantially regular intervals during the rotating movement of said disc.

84. A disc valve system according to claim 79, wherein said tension elements are mounted on the outer face of said chain sides, said dynamic member comprising openings near said each longitudinal ends receiving said chain sides therethrough without interfering therewith.

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85. A disc valve system according to claim 79, wherein said dynamic member comprises a generally elliptical shape defining an elliptical opening providing a free working space for said chain member.

86. A disc valve system according to claim 74, wherein said second sprocket gear is in operative communication with a disc-gear, said disc gear being in operative communication with said disc gear elements.

87. A disc valve system according to claim 86, wherein said second sprocket gear comprises an aperture for receiving an extending portion from said disc gear.

88. A disc valve system according to claim 87, wherein said second sprocket gear comprises a resilient member interposed between said second sprocket gear and said extending portion.

89. A disc valve system according to claim 88, wherein said second sprocket gear comprises a hub for holding said resilient member.

90. A disc valve system according to claim 89, wherein said resilient member defines an aperture for receiving said extending portion.

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91. A disc valve system according to claim 89, wherein said resilient member comprises a synthetic rubber material.

92. A disc valve system according to claim 86, wherein said disc-gear comprises a pinion gear and said disc gear elements comprise bevel teeth.

93. A disc valve system according to claim 74, wherein said at least one of said first and second sprocket gears comprises a resilient member.

94. A disc valve system according to claim 93, wherein said resilient member of said first sprocket gear is interposed therebetween and said crankshaft.

95. A disc valve system according to claim 93, wherein said resilient member of said second sprocket gear is interposed therebetween and a disc-gear in communication with said disc-gear elements.

96. A disc valve system according to claim 73, wherein said movement transfer assembly comprises an elongate member being rotatable about its longitudinal axis,. said elongate member comprising first and second elongate member gears at the longitudinal ends thereof, said first and second elongate member gears being in operative communication with said first and second gears respectively.

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97. A disc valve system according to claim 96, wherein said first and second elongate member gears first and second pinion gears respectively, said first and second gears comprising respective bevel teeth, said first and second gear bevel teeth being meshed with said first and second pinion gears respectively.

98. A disc valve system according to claim 96, wherein said second gear is in operative communication with a disc gear, said disc gear being in operative communication with said disc gear elements.

99. A disc valve system according to claim 98, wherein said disc gear comprises a disc pinion gear and said disc gear elements comprise gear teeth.

100. A disc valve system according to claim 97, wherein said disc pinion gear is mounted to said second gear.

101. A disc valve system according to claim 91, wherein said movement-transfer assembly comprises a plurality of communicating gears.

102. A piston driven internal combustion engine comprising:

at least one cylinder head manifold comprising exhaust and intake ports;

at least one engine cylinder housing a piston and defining a combustion chamber,

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at least one rotating disc mounted between said cylinder head manifold and said engine cylinder, said rotating disc comprising sequencing ports so configured as to be brought into periodic communication with said exhaust and intake ports at cyclic intervals of the rotating movement of said rotating disc thereby providing for said exhaust and intake ports to be brought into periodic communication with said combustion chamber; and

an intermediate seal member mounted within said said engine cylinder at a junction of said rotating disc and said engine cylinder so as to seal said combustion chamber, said intermediate seal member comprising a dynamic seal for contact with said rotating disc and a stationary seal for sealing contact with said engine cylinder;

whereby the rotating movement of said rotating disc sequentially opens and closes each said exhaust and intake ports synergistically with the translational movement of said piston.

103. An engine according to claim 102, wherein said disc comprises a generally central aperture for being in alignment with an aperture of said cylinder head manifold.

104. An engine according to claim 103, wherein said cylinder head manifold aperture is defined by a spark-plug receiving portion.

105. An engine according to claim 104, wherein said spark-plug receiving portion defines a threaded portion for fixedly receiving a spark plug.

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106. An engine according to claim 103, wherein said cylinder head manifold aperture is defined by a fuel-injector receiving portion.

107. An engine according to claim 106, wherein said fuel-injector receiving portion defines a threaded portion for fixedly receiving a fuel injector

108. An engine according to claim 102, wherein said disc comprises an outer face in a slidable sealing relationship with said cylinder head manifold and an opposite inner face in a slidable relationship with said intermediate seal member.

109. An engine according to claim 108, wherein said outer face comprises a generally central protrusion for slidably mating with a complementary indentation within the cylinder head manifold.

110. An engine according to claim 109, wherein said generally central protrusion comprises a tubular shaft.

111. An engine according to claim 110, wherein said tubular shaft defines an aperture for fixedly receiving a spark plug.

112. An engine according to claim 111, wherein said tubular shaft defines an aperture for fixedly receiving a fuel injector.

113. An engine according to claim 109, wherein said outer face comprises a generally circular protrusion for slidably mating

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with a complementary indentation comprised by said cylinder head manifold.

114. An engine according to claim 113, wherein said complementary indentation is defined by a layer of material added on said cylinder head manifold.

115. An engine according to claim 113, wherein said layer of material is selected from the group consisting of copper,

116. An engine according to claim 112, wherein said complementary indentation is formed within the cylinder head manifold.

117. An engine according to claim 108, wherein said inner face comprises a turbulator portion configured to provide for turbulence thereunder during the rotating movement of said disc.

118. An engine according to claim 117, wherein turbulator portion further comprises propeller members.

119. An engine according to claim 117, wherein said turbulator portion comprises a receding region within said inner face.

120. An engine according to claim 119, wherein said turbulator portion further comprises propeller members about said receding portion.

121. An engine according to claim 120, wherein said propeller members comprise blade members.

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122. An engine according to claim 121, wherein said blade members are generally circular shaped.

123. An engine according to claim 120, wherein said sequencing ports comprise apertures through said propeller members.

124. An engine according to claim 119, wherein said receding region is generally conical shaped.

125. An engine according to claim 108, wherein said inner face comprises a skirt portion for mating with said engine cylinder.

126. An engine according to claim 125, wherein said skirt portion and the engine cylinder comprise a sealing material therebetween.

127. An engine according to claim 102, wherein said rotating disk comprises gear elements.

128. An engine according to claim 127, wherein said gear elements comprise bevel teeth.

129. An engine according to claim 127, wherein said rotating disc comprises an inner face comprising said gear elements.

130 An engine according to claim 129, wherein said gear element is formed near the periphery of said rotating disc.

131. An engine according to claim 102, wherein said cylinder head manifold and said disc comprise a sealing material therebetween.

132. An engine according to claim 102, wherein said sequencing ports comprise at least one intake sequencing port and at least one exhaust sequencing port.

133. An engine according to claim 102, wherein said sequencing ports comprise apertures.

134. An engine according to claim 133, wherein said sequencing ports comprise respective shutter members.

135. An engine according to claim 136, wherein said shutter is so biased as to at least keep said port apertures partially closed.

136. An engine according to claim 135, wherein said shutter members are moveable towards a position that progressively opens said port apertures during the rotating movement of said disc.

137. An engine according to claim 136, wherein said shutter member comprises a moveable member positioned within said aperture, and mounted to a port wall via a biasing member.

138. An engine according to claim 133, wherein said biasing member comprises a spring.

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139. An engine according to claim 134, wherein said shutters comprise flaps which are mounted to said disc via a biasing member so biasing said flaps as to at least partially cover said sequencing port apertures.

140. An engine according to claim 139, wherein said biasing member comprises a spring.

141. An engine according to claim 132, wherein during the rotating movement of said disc, said intake sequencing port is brought into periodic communication with said cylinder head intake port and said exhaust sequencing port is brought into periodic communication with said cylinder head exhaust port.

142. An engine according to claim 141, wherein said at least one intake sequencing port and at least one exhaust sequencing port are moved by the rotating movement of said disc along a same orbital.

143. An engine according to claim 141, wherein said at least one least one intake sequencing port and at least one exhaust sequencing port are moved by the rotating movement of said disc along different respective orbitals.

144. An engine according to claim 102, wherein said sequencing ports comprise a plurality of intake sequencing ports and a plurality of exhaust sequencing ports.

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145. An engine according to claim 144, wherein said plurality of intake and exhaust sequencing ports are disposed in respective intake and exhaust series on said rotating disc.

146. An engine according to claim 145, wherein said series of said plurality of intake sequencing ports comprises intake sequencing ports of different dimensions.

147. An engine according to claim 146, wherein said plurality of intake sequencing ports comprises sequencing ports that increase in size in the direction from the centre of said disc to the periphery of said disc.

148. An engine according to claim 145, wherein said series of said plurality of exhaust sequencing ports comprises exhaust sequencing ports of different dimensions.

149. An engine according to claim 148, wherein said plurality of exhaust sequencing ports comprises sequencing ports that increase in size in the direction from the centre of said disc to the periphery of said disc.

150. An engine according to claim 102, wherein the cylinder head manifold comprises liquid bearings on a portion thereof that is in contact with said disc.

151. An engine according to claim 150, wherein said liquid bearings comprise channels formed within said cylinder head manifold portion.

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152. An engine according to claim 151, wherein said cylinder head manifold comprises a material plated on said portion, said liquid bearings comprising channels formed within said plated material.

153. An engine according to claim 102, wherein said intermediate seal member comprises a top face, a bottom face and an outer surface therebetween, said top face being in contact with said rotating disc and providing for said disc to rotate with respect thereto.

154. An engine according to claim 153, wherein said intermediate seal member comprises a ring member.

155. An engine according to claim 153, wherein said outer surface comprises said stationary seal.

156. An engine according to claim 155, wherein said stationary seal comprises a ring seal.

157. An engine according to claim 155, wherein said stationary seal seals the internal periphery of the engine cylinder about an opening thereof leading to said combustion chamber.

158. An engine according to claim 155, wherein said stationary seal extends beyond said seal member outer surface.

159. An engine according to claim 155, wherein said stationary seal is slidably mounted on said outer surface

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160. An engine according to claim 155, wherein said outer surface comprises a groove to hold said stationary seal.

161. An engine according to claim 160, wherein said groove slidably holds said stationary seal.

162. An engine according to claim 153, wherein said bottom face comprises at least one locking element to be mated with a complementary locking element of the engine cylinder.

163. An engine according to claim 162, wherein at least one said bottom face locking element comprises a recess and said complementary engine cylinder locking element comprises a pin.

164. An engine according to claim 163, wherein said recess is generally vertical with respect to said bottom face.

165. An engine according to claim 163, wherein said recess is generally slanted with respect to said bottom face.

166. An engine according to claim 153, wherein said bottom face comprises a configuration that is complementary to an inner top peripheral region of said cylinder.

167. An engine according to claim 162, wherein said bottom face securely sits on said inner top peripheral region within the engine cylinder.

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168. An engine according to claim 102, further comprising a disc-rotator assembly for causing the rotational movement of said rotating disc.

169. An engine according to claim 168, further comprising a crankshaft mounted to said piston, said disc-rotator assembly comprises a transmission assembly being configured to be put in operative communication with said crankshaft and with said rotating disc such that said disc rotates in relation to the revolution of said crankshaft, thereby providing for said disc to sequentially open and close each said exhaust and intake ports synergistically with the revolution of said crankshaft.

170. An engine according to claim 169, wherein said transmission assembly comprises a gear assembly, said disc comprising gear elements in operative communication with said gear assembly.

171. An engine according to claim 170, wherein said gear elements comprise bevel teeth.

172. An engine according to claim 170, wherein said gear assembly comprises a first gear in operative communication with said crankshaft, said first gear being in operative communication with a second gear, said second gear being in operative communication with said disc gear elements so as to transmit the movement of said crankshaft to said disc.

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173. An engine according to claim 172, wherein said first gear is mounted to said crankshaft.

174. An engine according to claim 172, wherein said gear assembly further comprises a movement-transfer assembly in operative communication with both said first and second gears for transmitting the movement of said first gear to said second gear.

175. An engine according to claim 173, wherein said first and second gears comprise first and second sprocket gears respectively, said movement-transfer assembly comprises a chain member mounted at one end to said first sprocket gear and at an opposite end to said second sprocket gear.

176. An engine according to claim 175, further comprising a tension-assembly being in contact with said chain member as to apply tension thereto thereby interruptingly retarding the rotating movement of said disc at given intervals thereof.

177. An engine according to claim 176, wherein said chain member defines two opposite chain sides between said first and second sprocket gears, said tension-assembly comprising tension elements mounted on said opposite chain sides.

178. An engine according to claim 177, wherein said tension-assembly further comprises a dynamic member mounted to said tension elements.

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179. An engine according to claim 178, wherein said dynamic member is made of resilient material.

180. An engine according to claim 178, wherein said tension-assembly comprises first and second opposite tension elements being mounted to a respective chain side, said dynamic member comprising an elongate member having said first and second tension elements mounted at each longitudinal end thereof.

181. An engine according to claim 180, wherein said first and second tension elements are mounted to biasing members for being biased towards a respective said chain side.

182. An engine according to claim 181, wherein said biasing members comprise tension springs.

183. An engine according to claim 180, wherein said first and second tension elements are so positioned and wherein said dynamic member is so configured as to collectively and reciprocally move side-to-side when said chain member acts on at least one of said first and second tension elements.

184. An engine according to claim 183, wherein said reciprocal movement provides for applying interrupted pressure on a each of said chain sides at a time and at substantially regular intervals during the rotating movement of said disc.

185. An engine according to claim 180, wherein said tension elements are mounted on the outer face of said chain sides,

said dynamic member comprising openings near said each longitudinal ends receiving said chain sides therethrough without interfering therewith.

186. An engine according to claim 180, wherein said dynamic member comprises a generally elliptical shape defining an elliptical opening providing a free working space for said chain member.

187. An engine according to claim 175, wherein said second sprocket gear is in operative communication with a disc-gear, said disc gear being in operative communication with said disc gear elements.

188. An engine according to claim 187, wherein said second sprocket gear comprises an aperture for receiving an extending portion from said disc gear.

189. An engine according to claim 188, wherein said second sprocket gear comprises a resilient member interposed between said second sprocket gear and said extending portion.

190. An engine according to claim 189, wherein said sprocket gear comprises a hub for holding said resilient member.

191. An engine according to claim 190, wherein said resilient member defines an aperture for receiving said extending portion.

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192. An engine according to claim 191, wherein said resilient member comprises a material selected from the group consisting of natural rubber, synthetic rubber and combinations thereof.

193. An engine according to claim 179, wherein said disc-gear comprises a pinion gear and said disc gear elements comprise gear teeth.

194. An engine according to claim 175, wherein said at least one of said first and second sprocket gears comprises a resilient member.

195. An engine according to claim 194, wherein said resilient member of said first sprocket gear is interposed therebetween and said crankshaft.

196. An engine according to claim 194, wherein said resilient member of said second sprocket gear is interposed therebetween and a disc-gear in communication with said disc-gear elements.

197. An engine according to claim 174, wherein said movement transfer assembly comprises an elongate member being rotatable about its longitudinal axis, said elongate member comprising first and second elongate member gears at the longitudinal ends thereof, said first and second elongate member gears being in operative communication with said first and second gears respectively.

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198. An engine according to claim 197, wherein said first and second elongate member gears comprise first and second pinion gears respectively, said first and second gears comprising respective bevel teeth, said first and second gear bevel teeth being meshed with said first and second pinion gears respectively.

199. An engine according to claim 197, wherein said second gear is in operative communication with a disc gear, said disc gear being in operative communication with said disc gear elements.

200. An engine according to claim 199, wherein said disc gear comprises a disc pinion gear and said disc gear elements comprise gear teeth.

201. An engine according to claim 198, wherein said disc pinion gear is mounted to said second gear.

202. An engine according to claim 169, wherein said transmission assembly comprises a plurality of communicating gears.

203. A rotatable disc valve for mounting between a cylinder head manifold having exhaust and intake ports and an engine cylinder housing a piston and defining a combustion chamber of a piston driven internal combustion engine, said disc valve comprising:

an outer face facing the cylinder head manifold when said disc valve is mounted thereto;

an inner face facing the engine cylinder when said disc valve is mounted thereto, said inner face comprising a turbulator; and

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sequencing ports so configured as to be brought into periodic communication with said exhaust and intake ports at cyclic intervals of the rotating movement of said disc thereby providing for said exhaust and intake ports to be brought into periodic communication with said combustion chamber;

whereby said turbulator portion is configured to provide for turbulence thereunder during the rotating movement of said disc.

204. A disc valve according to claim 203, wherein said disc valve further comprises a generally central aperture for being in alignment with an aperture of the cylinder head manifold.

205. A disc valve according to claim 204, wherein said turbulator portion is formed about said generally central aperture.

206. A disc valve according to claim 203, wherein turbulator portion comprises propeller members.

207. A disc valve according to claim 203, wherein said turbulator portion comprises a receding region within said inner face.

208. A disc valve according to claim 207, wherein said turbulator portion further comprises propeller members about said receding portion.

209. A disc valve according to claim 208, wherein said propeller members comprise blade members.

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210. A disc valve according to claim 209, wherein said blade members are generally circular shaped.

211. A disc valve according to claim 208, wherein said sequencing ports comprise apertures through said propeller members.

212. A disc valve according to claim 204, wherein said receding region is generally conical shaped.

213. A disc valve according to claim 203, wherein said outer face comprises a generally central protrusion for slidably mating with a complementary indentation within the cylinder head manifold.

214. A disc valve according to claim 213, generally central protrusion comprises a tubular shaft.

215. A disc valve according to claim 214, wherein said tubular shaft defines an aperture for fixedly receiving a spark plug.

216. A disc valve according to claim 214, wherein said tubular shaft defines an aperture for fixedly receiving a fuel injector.

217. A disc valve system according to claim 203, wherein said outer face comprises a generally circular protrusion for slidably mating with a complementary indentation comprised by the cylinder head manifold.

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218. A disc valve according to claim 203, wherein said inner face comprises a skirt portion for mating with the engine cylinder.

219. A disc valve according to claim 203, further comprising gear elements.

220. A disc valve according to claim 219, wherein said gear elements comprise bevel teeth.

221. A disc valve according to claim 219, said inner face comprises said gear elements.

222. A disc valve according to claim 219, wherein said gear elements are formed near the periphery of said disc valve.

223. A disc valve according to clairn 203, wherein said sequencing ports comprise at least one intake sequencing port and at least one exhaust sequencing port.

224. A disc valve according to claim 203, wherein said sequencing ports comprise apertures.

225. A disc valve according to claim 224, wherein said sequencing ports comprise respective shutter members.

226. A disc valve according to claim 225, wherein said shutters are so biased as to at least keep said port apertures partially closed.

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227. A disc valve according to claim 226, wherein said shutters are moveable towards a position that progressively opens said port apertures during the rotating movement of said disc valve.

228. A disc valve according to claim 227, wherein each said shutter comprises a moveable member positioned within said aperture, and mounted to a port wall via a biasing member.

229. A disc valve according to claim 228, wherein said biasing member comprises a spring.

230. A disc valve according to claim 225, wherein said shutters comprise flaps which are mounted to said disc via a biasing member so biasing said flaps as to at least partially cover said sequencing port apertures.

231. A disc valve according to claim 230, wherein said biasing member comprises a spring.

232. A disc valve according to claim 223, wherein during the rotating movement of said disc, said intake sequencing port is brought into periodic communication with said cylinder head intake port and said exhaust sequencing port is brought into periodic communication with said cylinder head exhaust port.

233. A disc valve according to claim 232, wherein said at least one intake sequencing port and at least one exhaust

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sequencing port are moved by the rotating movement of said disc along a same orbital.

234. A disc valve according to claim 232, wherein said at least one intake sequencing port and at least one exhaust sequencing port are moved by the rotating movement of said disc along different respective orbitals.

235. A disc valve according to claim 203, wherein said sequencing ports comprise a plurality of intake sequencing ports and a plurality of exhaust sequencing ports.

236. A disc valve according to claim 235, wherein said plurality of intake and exhaust sequencing ports are disposed in respective intake and exhaust series on said rotating disc.

237. A disc valve according to claim 236, wherein said series of said plurality of intake sequencing ports comprises intake ports of different dimensions.

238. A disc valve according to claim 237, wherein said plurality of intake sequencing ports comprises sequencing ports that increase in size in the direction from the centre of said disc to the periphery of said disc.

239. A disc valve according to claim 236, wherein said series of said plurality of exhaust sequencing ports comprises exhaust ports of different dimensions.

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240. A disc valve according to claim 239, wherein said plurality of exhaust sequencing ports comprises sequencing ports that increase in size in the direction from the centre of said disc to the periphery of said disc.

241. A rotatable disc valve for mounting between a cylinder head manifold having exhaust and intake ports and an engine cylinder housing a piston and defining a combustion chamber of piston driven internal combustion engine, said disc comprising:

sequencing port apertures so configured as to be brought into periodic communication with said exhaust and intake ports at cyclic intervals of the rotating movement of said disc thereby providing for said exhaust and intake ports to be brought into periodic communication with said combustion chamber, said sequencing port apertures comprising respective shutter members biased towards a first positioned which at least keeps a respective port aperture partially closed;

whereby said shutter members are moveable towards a position that progressively opens said port apertures during the rotating movement of said disc valve.

242. A disc valve according to claim 241, wherein a given said shutter member comprises a moveable member positioned within said aperture and mounted to a port wall via a biasing member.

243. A disc valve according to claim 242, wherein said biasing member comprises a spring.

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244. A disc valve according to claim 241, wherein said shutter members comprise flaps which are mounted to said disc via a biasing member so biasing said flaps as to at least partially cover said sequencing port apertures.

245. A disc valve according to claim 244, wherein said biasing member comprises a spring.

246. A rotatable disc valve for mounting between a cylinder head manifold having exhaust and intake ports and an engine cylinder housing a piston and defining a combustion chamber of piston driven internal combustion engine, said disc comprising:

a plurality of intake and exhaust sequencing ports of differing dimensions being disposed in respective intake and exhaust series, said intake and exhaust sequencing port apertures being so configured as to be respectively brought into periodic communication with said exhaust and intake ports at cyclic intervals of the rotating movement of said disc thereby providing for said exhaust and intake ports to be brought into periodic communication with said combustion chamber.

247. A disc valve according to claim 246, wherein said plurality of intake sequencing ports comprises sequencing ports that increase in size in the direction from the centre of said disc to the periphery of said disc valve.

248. A disc valve according to claim 246, wherein said plurality of intake sequencing ports comprise sequencing ports

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that decrease in size in the direction from the centre of said disc to the periphery of said disc valve.

249. A disc valve according to claim 246, wherein said plurality of exhaust sequencing ports comprises sequencing ports that increase in size in the direction from the centre of said disc to the periphery of said disc valve.

250. A disc valve according to claim 246, wherein said plurality of exhaust sequencing ports comprise sequencing ports that decrease in size in the direction from the centre of said disc to the periphery of said disc valve.

251. A rotatable disc valve for mounting between a cylinder head manifold having exhaust and intake ports and an engine cylinder housing a piston and defining a combustion chamber of piston driven internal combustion engine, said disc comprising:

an outer face facing the cylinder head manifold when said disc valve is mounted thereto;

sequencing port apertures so configured as to be brought into periodic communication with said exhaust and intake ports at cyclic intervals of the rotating movement of said disc thereby providing for said exhaust and intake ports to be brought into periodic communication with said combustion chamber,

said outer face comprising a generally circular protrusion closer to the periphery of said disc valve than to said centre thereof for mating with a complementary indentation formed in the cylinder head manifold.

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252. An intermediate seal member for a piston-driven combustion engine comprising

a rotating disc valve and

an engine cylinder defining a combustion chamber and housing a piston;

said intermediate seal member being mountable within the engine cylinder at a junction of the rotating disc valve and the engine cylinder, said intermediate seal member comprising a dynamic seal for contact with the rotating disc valve and a stationary seal for sealing contact with the engine cylinder, said intermediate seal member comprising a top face, a bottom face and an outer surface therebetween, said top face being in contact with said rotating disc and providing for said disc to rotate with respect thereto, said outer surface comprises said stationary seal

wherein during operation of the piston-driven combustion engine, said intermediate seal member seals the combustion chamber.

253. An intermediate seal member according to claim 252, wherein said intermediate seal member comprises a ring member.

254. An intermediate seal member according to claim 252, wherein said stationary seal comprises a ring seal.

255. An intermediate seal member according to claim 252, wherein said stationary seal seals the internal periphery of the engine cylinder about an opening thereof leading to the combustion chamber.

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256. An intermediate seal member according to claim 252, wherein said stationary seal extends beyond said seal member outer surface.

257. An intermediate seal member according to claim 252, wherein said stationary seal is slidably mounted on said outer surface

258. An intermediate seal member according to claim 252, wherein said outer surface comprises a groove to hold said stationary seal.

259. An intermediate seal member according to claim 258, wherein said groove slidably holds said stationary seal.

260. An intermediate seal member according to claim 252, wherein said bottom face comprises at least one locking element to be mated with a complementary locking element of the engine cylinder.

261. An intermediate seal member according to claim 260, wherein said at least one bottom face locking element comprises a recess and said complementary engine cylinder locking element comprises a pin.

262. An intermediate seal member according to claim 261, wherein said recess is generally vertical with respect to said bottom face.

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263. An intermediate seal member according to claim 261, wherein said recess is generally slanted with respect to said bottom face.

264. An intermediate seal member according to claim 252, wherein said bottom face comprises a configuration that is complementary to an inner top peripheral region of said cylinder.

265. An intermediate seal member according to claim 264, wherein said bottom face securely sits on said inner top peripheral region within the engine cylinder.

266. A timing gear for a disc valve engine, said timing gear having a hub aligned concentrically about its axis of rotation, said hub holding a resilient member, said timing gear rotatively mounted on a timing shaft, said timing shaft comprising a bevel gear fixedly attached at one end and a plurality of lateral members fixedly attached at the opposite end, said lateral members passing through the center of said resilient member and in contact with a plurality of recessed niches in said resilient member.

267. A timing gear according to claim 266, wherein said pinion bevel gear turning said bevel gear comprises a pinion turning a gear.

268. A timing gear according to claim 266, wherein said resilient member comprises material selected from the group consisting of a natural rubber compound, a synthetic rubber and combinations thereof.

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269. A timing gear according to claim 266, wherein said resilient member is fixedly secured by a plurality of matching interfacing sector contours configured in said resilient member and reversely contoured in said hub.

270. A disc valve system for a piston driven internal combustion engine operating on the stroke thermodynamic principle, said disc valve system comprising:

a disc rotatively mounted between the cylinder head and engine cylinder of the piston driven internal combustion engine, the engine cylinder defining a combustion chamber with said disc, the cylinder head comprising exhaust and intake ports, said disc comprising gear elements so configured as to be made to rotate in a synergistic relationship with the crankshaft of the engine and at a predetermined fraction of a revolution to each one full revolution of the crankshaft, said disc comprising a number of ports spaced apart at predetermined intervals, and

an intermediate seal member for mounting within the engine cylinder at a junction of said disc and the engine cylinder so as to seal the combustion chamber, said intermediate seal member comprising a dynamic seal for contact with said disc and a stationary seal for sealing contact with the engine cylinder;

wherein, during rotation of said disc, said disc ports are brought into periodic alignment with said exhaust and intake ports at cyclic intervals, thereby, bringing the combustion chamber into periodic communication with said exhaust and intake ports synergistically with the stroke thermodynamic principle, said cyclic intervals being determined by:

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- said synergistic relationship between the crankshaft and said disc;
- the disposition, configuration and number of said disc ports; and
- the disposition, configuration and number of said exhaust and intake ports.

271. A disc valve system according to claim 270 further comprising a disc rotator in communication with said gear elements and the crankshaft so as to transfer the movement of the crankshaft to said disc, wherein the configuration of the disc rotator is also determinant of said cyclic intervals.

272. A multifunctional disc for mounting between a cylinder head manifold having exhaust and intake ports and an engine cylinder housing a piston and defining a combustion chamber of a piston driven internal combustion engine, said disc comprising:

a generally flat and single integral body having one face in rotational contact with the cylinder head and an opposite face in rotational contact with the engine cylinder when said disc is mounted between the cylinder head and the engine cylinder; said body comprising:

a gear comprising gear elements near the periphery of said disc body for providing rotational movement to said disc body;

a valve comprising sequencing ports so configured as to be brought into periodic communication with said exhaust and intake ports at cyclic intervals of the rotating movement of said disc body thereby providing for said exhaust and intake ports to be brought into periodic communication with the combustion chamber;

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a turbulator configured to provide turbulence in the combustion chamber during the rotating movement of said disc body; and

a seal for sealing the open portion of the engine cylinder, said seal comprising an indentation for receiving the rim of the engine cylinder.

273. An intermediate seal member for a piston-driven combustion engine comprising

a rotating disc valve; and

an engine cylinder defining a combustion chamber and housing a piston,

said intermediate seal member being mountable within the engine cylinder at a junction of the rotating disc valve and the engine cylinder, said intermediate seal member comprising a top face, for contact with said disc valve, a bottom face and an outer surface therebetween for contact with said engine cylinder,

wherein during operation said intermediate seal member is so responsive to the pressure of the combustion chamber as to move in the direction of the translational direction of the piston head during operation thereby sealing the combustion chamber,.

274. An intermediate seal member according to claim 273, wherein said top face comprising a dynamic seal for contact with the rotating disc valve.

275. An intermediate seal member according to claim 274, wherein said top face is in rotative contact with the disc valve.

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276. An intermediate seal member according to claim 273, wherein said outer face comprises a stationary seal for sealing contact with the engine cylinder.

277. An intermediate seal member according to claim 273, wherein said intermediate seal member seals the combustion volume within the combustion chamber.

278. An intermediate seal member according to claim 277, wherein said disc valve is in communication with a cylinder head comprising intake and outtake ports, said combustion volume being measured as the area between the head of the engine piston and the disc valve.

279. An intermediate seal member according to claim 278, wherein said intermediate seal member limits the axial length of said combustion volume.

280. An intermediate seal member according to claim 275, wherein said disc valve is in communication with a cylinder head comprising intake and outtake ports, said intermediate seal member being so responsive to said pressure of the combustion chamber as to be moveable towards the disc valve.

281. An intermediate seal member according to claim 280, wherein said intermediate seal member is so responsive to said pressure of the combustion chamber as to push the disc valve towards the cylinder head.